Abstract

Plasmonic influence of gold nanoparticles (AuNPs) on the performance of graphene (Gr)-platinum (Pt) nanocomposite counter electrodes (CEs) in dye-sensitized solar cells was investigated. Solar cells with Pt based CEs namely: Pt, Gr/Pt and Gr/AuNPs/Pt presented photocurrent densities (J_{sc}) of 9.10, 9.55 and 9.92 mA/cm^2 and power conversion efficiencies of 3.7, 4.2, and 4.6%, in that order, translating to 13.4 and 24.9% enhancement for Gr/Pt and Gr/AuNPs/Pt, respectively, based on the control Pt cell. The efficiency of Gr/AuNPs with no Pt layer was 1.4% constituting a 62.8% decrease compared to Pt cell and 236.0% lower than the Gr/AuNPs/Pt cell. The individual performance contribution of Gr in the Pt solar cell was 13.4% while that of AuNPs was 10.1%. Enhancement of the solar cells efficiency by both graphene and AuNPs was attributed to the increased electrocatalytic activity of the graphene matrix and the increased light absorption resulting from the plasmonic resonance property of AuNPs.